

REMARKS

Claims 1-2, 5-6, 9-10, and 31-51 are now pending in the application and have been rejected. Claims 34, 36, 37, 40, 42, 44, 45, 48, 49 and 50 have been amended. The Examiner is respectfully requested to reconsider and withdraw the rejections in view of the remarks contained herein.

Rejection Under 35 U.S.C. § 112

Claims 1-2, 5-6, 9-10 and 31-38 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. This rejection is respectfully traversed.

Regarding claims 1 and 5, the Office Action states that Applicant must clarify the specific structure to optimize the magnetic field. The Office Action also seeks clarification of “a desired magnetic field property”, “a selected point”, and “a selected direction”. Applicant respectfully submits that claims 1 and 5 are sufficiently definite in light of the specification.

Claims 1 and 5 recite a “permanent magnet in which the magnetization direction varies ... with location to optimize a desired magnetic field property in a selected direction at a selected point.” Applicant respectfully submits that a “permanent magnet in which the magnetization direction varies...with location” is a specific structure. A magnet recited in claims 1 and/or 5 has a plurality of dipole elements, which may be actual microscopic magnetic domains in a material, or macroscopic magnetic segments assembled to form the magnet (specification, page 8, lines 5-9). In both cases, the magnetization direction varies with location in the magnet based on “a selected point”, “a desired magnetic field property” and “a selected direction”.

Applicant submits that a “selected point” also is sufficiently described in the specification. The first step in the preferred embodiment for developing a magnet like that recited in claims 1 and/or 5 is to calculate the relationship between α (magnetization angle) and θ (element position angle *relative to the selected point*) for the selected magnetic field property *and selected location for the magnet* (specification, page 11, lines 11-13; Fig. 1). A magnet recited in the claims is useful, for example, for controlling magnetic medical devices inside a patient in magnetic surgical procedures (specification, page 2, line 9-10; page 10, lines 22-23; page 11, lines 1-2). The claimed magnet can be supported and manipulated more easily than conventional magnets in an operating procedure room (specification, page 2, lines 9-12). In a medical

procedure, a “selected point”, also referred to as an “application point”, of the magnet which in use is positioned in a patient procedure volume (specification, page 8, lines 18-19; page 13, lines 18-21; page 14, lines 1-2). An application point is shown in Fig. 1 at the origin of the x- and y-axes, at a distance $|r|$ from a local magnetic moment. The orientation of the elemental magnetic moment \mathbf{m} for each location in the magnet is determined to maximize a selected magnetic field property *at the selected operating point* (specification, page 8, lines 17-19). As shown in Fig. 6, a magnetization direction α is determined for an elemental magnetic moment \mathbf{m} based on the position angle θ of the element *relative to the selected point* (Fig. 1; specification, page 14, lines 2-13). In one embodiment, the completed magnet is operated so that *the procedure point in a patient* is on the central x-y plane (specification, page 11, lines 1-2). Selected application points spaced from the magnet face also are shown in Figs. 2-5.

Applicant respectfully submits that “to optimize a desired magnetic field property in a selected direction” also is sufficiently described in the specification. A plurality of exemplary desired magnetic field properties are described in the specification, including magnetic field, gradient of a magnetic field, and product of a magnetic field and the gradient of the magnetic field. A magnet of the present invention is useful for optimizing such a magnetic field property at the selected point, “in a selected direction”. Thus, for example, the magnet shown in Figs. 2 provides a magnetic field, in a transverse direction, that is optimized at a selected point spaced from the magnet face. As another example, a magnet can be constructed to maximize a gradient component in a desired gradient direction, e.g., $\partial b_x / \partial x$, i.e., the transverse gradient of a transverse field (Fig. 19; specification, page 18, lines 6-16).

Regarding claims 9-10, the Office Action states that Applicant should clarify the specifics of the medical procedure. Applicant respectfully submits that claims 9-10 are sufficiently definite in light of the specification. The magnets recited in the claims are particularly useful for magnetic surgical applications, but can be used in any application (specification, page 8, lines 3-4). The magnets recited in the claims are advantageous over prior art magnets, in that the structures needed to support massive conventional magnets that provide an equivalent magnetic field are expensive and cumbersome (specification, page 1, lines 12-13). When used for magnetic surgical procedures, a magnet of the claimed invention allows smaller, less cumbersome equipment to be used to support and manipulate the magnet, and reduces the opportunity of interference with people and equipment in the procedure room (specification, page 2, lines 9-12).

Regarding claims 31-32, the Office Action states that Applicant should clarify what is intended by “the desired magnetic field” and “a selected direction” and “a selected point”. Applicant has amended claim 31 and 32 to remove reference to “the desired magnetic field”.

Applicant has discussed “selected direction” and “selected point” above, and respectfully submits that such terms are sufficiently definite under 35 U.S.C. §112.

Regarding claim 33, Applicant is requested to clarify the structure and/or arrangement to enable the magnetization to vary in three dimensions. The claimed magnet has a plurality of magnetic segments assembled to form the magnet (specification, page 8, lines 5-9). As discussed above in connection with claims 1 and 5, the magnetization direction varies with location in the magnet based on “a selected point”, “a desired magnetic field property” and “a selected direction”.

Applicant also is asked to clarify what is intended in claim 33 by “the selected point in the selected direction”. “[T]he selected point in the selected direction” refers to “a selected point in a selected direction” previously recited in claim 33. A “selected point” is, *e.g.*, a selected operating point in a patient procedure volume (specification, page 8, lines 18-19; page 13, lines 18-21; page 14, lines 1-2). A “selected direction” in which the field is optimized may be, *e.g.*, transverse or axial.

Regarding claim 34, the claim is amended for consistency with claim 33. Regarding a “surface of constant contribution”, in designing a magnet of the claimed invention, one would first generally select the desired shape of the magnet. This is most conveniently done with two-dimensional organization by using the curves of constant contribution for the magnetic field property that is to be optimized, to give the shape in two dimensions, *i.e.*, in the x-y plane. The height in the z-axis can then be selected based on the available space, desired weight, and required field strength (specification, page 21, lines 1-6). Thus at least some of the surfaces of the magnets of this invention, and in particular the surfaces that face away from the selected point of application of the optimized field property, conform to the surface of constant contribution (specification, page 22, lines 16-21).

Regarding claim 35, Applicant respectfully submits that is unclear which claim actually is being addressed by the Office Action, since claim 35 makes no reference to two dimensions.

Regarding claim 36, Applicant is requested to clarify the structure and arrangement to enable the claimed contribution. Claim 36 is amended for consistency with claim 33. Amended claim 36 recites a magnet “...wherein the direction of magnetization throughout each permanent magnet segment is the direction which...provides the maximum contribution to optimizing the field.” Thus it is the magnetization throughout each segment that enables the maximum contribution.

Regarding claim 37, Applicant is requested to clarify the “effective magnet center” and the structure and arrangement to enable the claimed contribution. Claim 37 is amended for

consistency with claim 33. The “effective magnet center” is supported by the specification. For example, the magnetization direction for a magnet segment could be selected to be the ideal direction at the location of the magnetic center of the segment, *i.e.*, the location at which a single magnet dipole of equivalent strength could replace the segment (specification, page 22, lines 6-9).

Regarding claim 40, the claim is amended to depend from claim 34. Applicant respectfully submits that the amendment obviates the need to further respond to the Office Action request regarding claim 40.

Regarding claims 41-45 and 48, Applicant submits that the requests stated in the Office Action have been addressed above in connection with other claims or have been obviated by amendment. Specifically, claims 42, 44, 45 and 48 are amended for consistency.

Regarding claim 49, the claim is amended to clarify that the magnetic field is produced by the claimed magnet. “Conforming to the surface of equal contribution” has been previously discussed in connection with other claims.

Regarding claim 50, the claim is amended to recite “a continuously varying magnetization direction”.

Rejection Under 35 U.S.C. § 103

Claims 1-2, 5-6 and 31-38 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Leupold, U.S. Pat. No. 5,216,400 (“Leupold”). This rejection is respectfully traversed. Leupold discloses a magnetic shell around a hollow cavity. A linearly tapered magnetic field is produced in the cavity because the permanent magnetization in the shell varies in magnitude (column 4, lines 47-51). The Office Action states that Leupold discloses a “magnet ...having varying magnetic directions... at selected points”. Leupold, however, does not teach a magnet that is configured to optimize a magnetic field property, let alone to optimize a magnetic field property in a selected direction at a selected point.

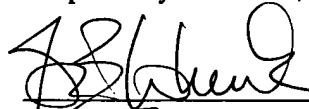
More specifically, claim 1 (and claim 2 which depends from claim 1) requires a magnet in which the magnetization direction varies in three dimensions with location to optimize a desired magnetic field property in a selected direction at a selected point. There is no optimization of a field property at any particular point or in any particular direction Leupold. Similarly, claim 5 (and claim 6 which depends from claim 5) requires a permanent magnet in which the magnetization direction varies in two dimensions with location to optimize a desired magnetic field property in a selected direction at a selected point. There is no optimization of a field property at any particular point or in any particular direction in Leupold.

Claims 9-10 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Leupold, U.S. Pat. No. 5,216,400 ("Leupold"), in view of Golden et al., U.S. Pat. No. 5,622,169 ("Golden et al."). This rejection is respectfully traversed. First, it would not have been obvious to use the magnet of Leupold for the magnet of Golden et al. The magnetic member of Golden et al. is used within the body of a patient. The working magnetic field produced by the magnet of Leupold is in a cavity inside the magnet. Neither Leupold nor Golden et al., alone or in combination, teach or suggest a method of performing a medical procedure using a magnet to project a magnetic field into a patient to control a magnetic medical element inside the patient. Moreover, and as discussed above with respect to claim 1, Leupold does not teach or suggest a magnet as set forth in claim 1. The Leupold magnet is not configured to optimize a magnetic field property in a selected direction at a particular point. Thus, no combination of Leupold and Golden et al. can make the use of such a magnet obvious.

Conclusion

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider and withdraw all presently outstanding rejections. Applicant submits that upon entry of the above amendments and consideration of the above remarks, all the claims pending in this application will be in condition for allowance. If it would advance the prosecution of this application, the Examiner is invited to telephone the undersigned.

Respectfully submitted,



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